

SD

11

.A7995

232,327.2

C

**CYLINDROCLADIUM ROOT ROT-DAMAGING
YELLOW-POPLAR SEEDLINGS IN A
NORTH CAROLINA NURSERY**



U. S. DEPARTMENT OF AGRICULTURE — FOREST SERVICE
SOUTHEASTERN AREA, STATE AND PRIVATE FORESTRY
DIVISION OF FOREST PEST CONTROL

CYLINDROCLADIUM ROOT ROT - DAMAGING YELLOW-POPLAR
SEEDLINGS IN A NORTH CAROLINA NURSERY

By

C.E. Cordell, C.E. Affeltranger and A.H. Maxwell^{1/}

U.S. Forest Service
Asheville, North Carolina

ABSTRACT

The root rot fungus, *Cylindrocladium scoparium* Morgan, was recently associated with extensive damage to 1-0 yellow-poplar seedlings in the Ralph Edwards State Forest Nursery at Morganton, N.C. Field examinations revealed that 70% of approximately 250 M seedlings in 27 nursery beds were damaged. A large majority of these seedlings were dead. The total area affected consisted of 1.21 acres. The soil fumigant MC-33 (methyl bromide - 67% and chloropicrin - 33%) was injected into the soil at the rate of 300 pounds per acre in an effort to control the disease.

INTRODUCTION

Cylindrocladium root rot, caused by the fungus *Cylindrocladium scoparium* Morgan, (Deuteromycetes: Mucedinaceae), has been observed periodically damaging hardwood as well as conifer nursery seedlings in the United

^{1/} Plant Pathologists, Division of Forest Pest Control, SA, S&PF, Asheville, North Carolina and Pest Control Forester, North Carolina Division of Forestry, Morganton, North Carolina.

States during the past 30 odd years. The potential of *C. scoparium* as a damaging fungus was emphasized by the extension of its known host range (Cox, 1954). The list of host plants has since been lengthened to include additional conifers and hardwoods along with agricultural plants and ornamentals. Its occurrence on yellow-poplar was first reported by Jackson (1938). However, it wasn't until recently that the associated pathogenicity of *C. scoparium* to a root and stem rot of yellow-poplar was demonstrated (Kelman and Gooding, 1965). Ross (1967) observed root rot associated mortality in a 27-year-old yellow-poplar plantation. However, the disease has been found most frequently in nursery stock.

In recent years, nurseries in the Southern Appalachians have sustained periodic heavy losses from *Cylindrocladium* root rot. Approximately ten years ago, severe mortality was observed in association with *C. scoparium* infection in conifer and yellow-poplar nursery stock at the Holmes State Forest Nursery near Hendersonville, North Carolina. In 1966, this root rot disease was associated with severe yellow-poplar seedling mortality in a forest nursery at Parsons, West Virginia. In 1968, many pine and all of the yellow-poplar and black walnut seedlings were killed at the Parsons Nursery. During September, 1968, a similar disease problem was observed in 1-0 yellow-poplar seedling beds at the Ralph Edwards State Forest Nursery near Morganton, North Carolina. The North Carolina Division of Forestry requested assistance from the Division of Forest Pest Control in solving this problem. The authors were assisted by William Strawn, Tree Improvement Forester, and Paul McCall, Nurseryman.

METHODS

A limited survey was made of the 27 affected yellow-poplar beds in Sections 15, 16 and 17 of Compartment E (Fig. 1). Approximately 250 M seedlings are in the 1.21 acre area. Systematic seedling counts were made to determine the amount (percent) of infection and mortality. In addition, spot checks were made of affected seedlings to determine the type(s) of symptom expression associated with the damage. Damaged seedlings were collected for laboratory examination and cultural diagnosis.

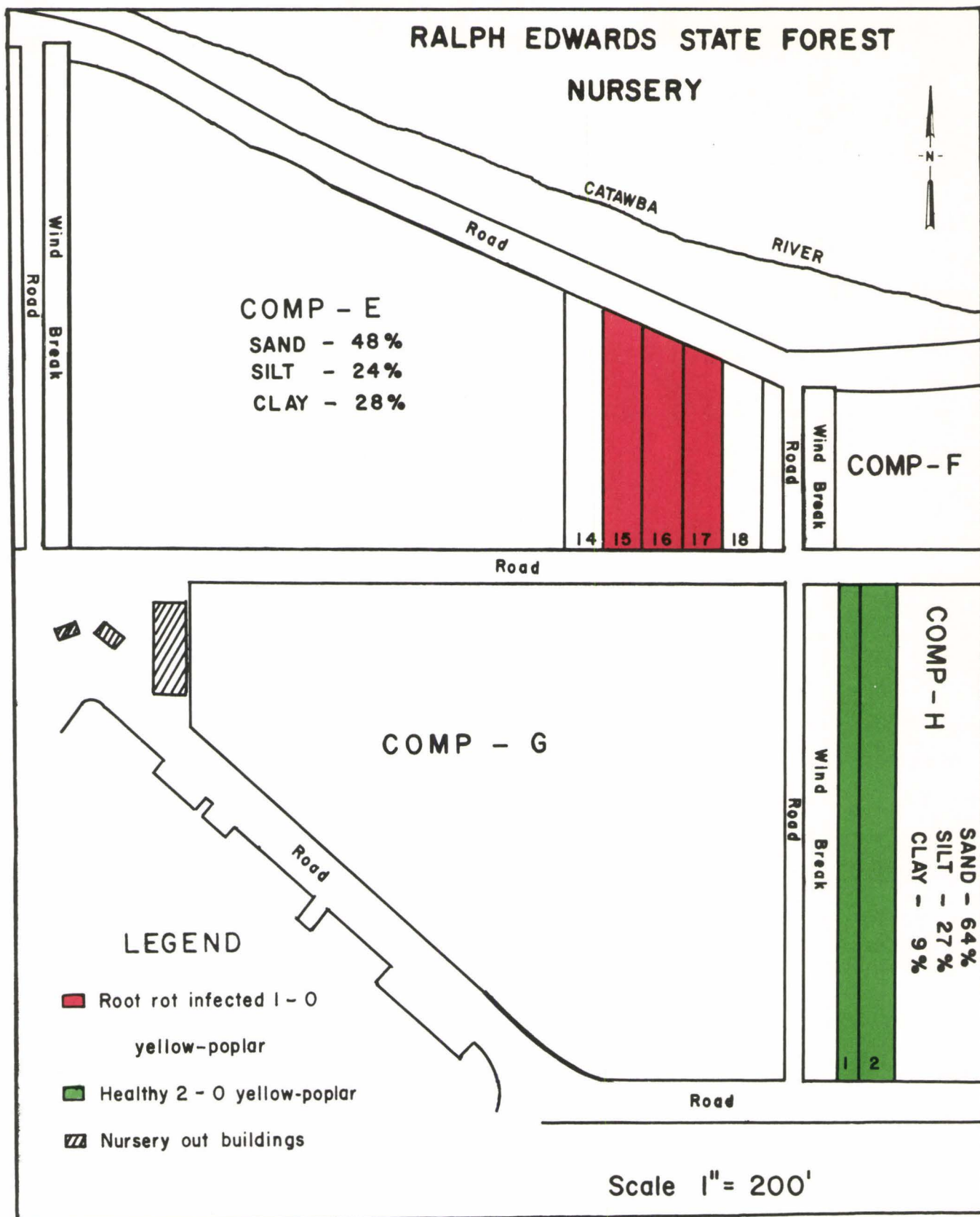


Figure 1. Location of *Cylindrocladium* root rot in 1-0 yellow-poplar seedlings at the Ralph Edwards State Forest Nursery

RESULTS

Examination of the affected yellow-poplar seedling beds revealed extensive foliage discoloration accompanied by severe mortality (cover). Systematic seedling counts showed approximately 70% of the seedlings with obvious damage. The majority of these seedlings were already dead. This resulted in a monetary loss to the nursery of approximately \$2,500.00.

Along with the discolored foliage, the most obvious symptom associated with the damage was a pronounced blackening of the yellow-poplar roots which was in sharp contrast to the white roots of apparently unaffected seedlings (Fig. 2). In many cases, there was also a longitudinal cracking or splitting associated with the blackened roots.

Laboratory diagnosis revealed that the root rot fungus *C.scoparium* was associated with the damage. Isolations were made in accordance with standard root isolation techniques.

DISCUSSION

Cylindrocladium root rot is one of the most virulent fungal pathogens in forest nurseries. The resting stage of this fungus, a sclerotium, is apparently resistant to standard nursery soil fumigation treatments (i.e. methyl bromide at 300 pounds per acre). This apparently makes *C.scoparium* more potent than other soil borne fungi (i.e. *Fusarium* and *Rhizoctonia*).

Cylindrocladium scoparium overwinters in a thick-walled sclerotia (resting stage) that is produced in abundance. In the presence of susceptible hosts, warm, moist soil favors germination of these resting bodies as well as rapid (mycelial) growth of fungus mycelium. When infected roots die the sclerotial resting bodies are released and reinfect the soil.

In the past, *C. scoparium* infection and related damage has been observed almost exclusively in second year and transplanted nursery stock. However, the yellow-poplar seedlings in this case were less than one year old; the seed having been sown in May, 1968.

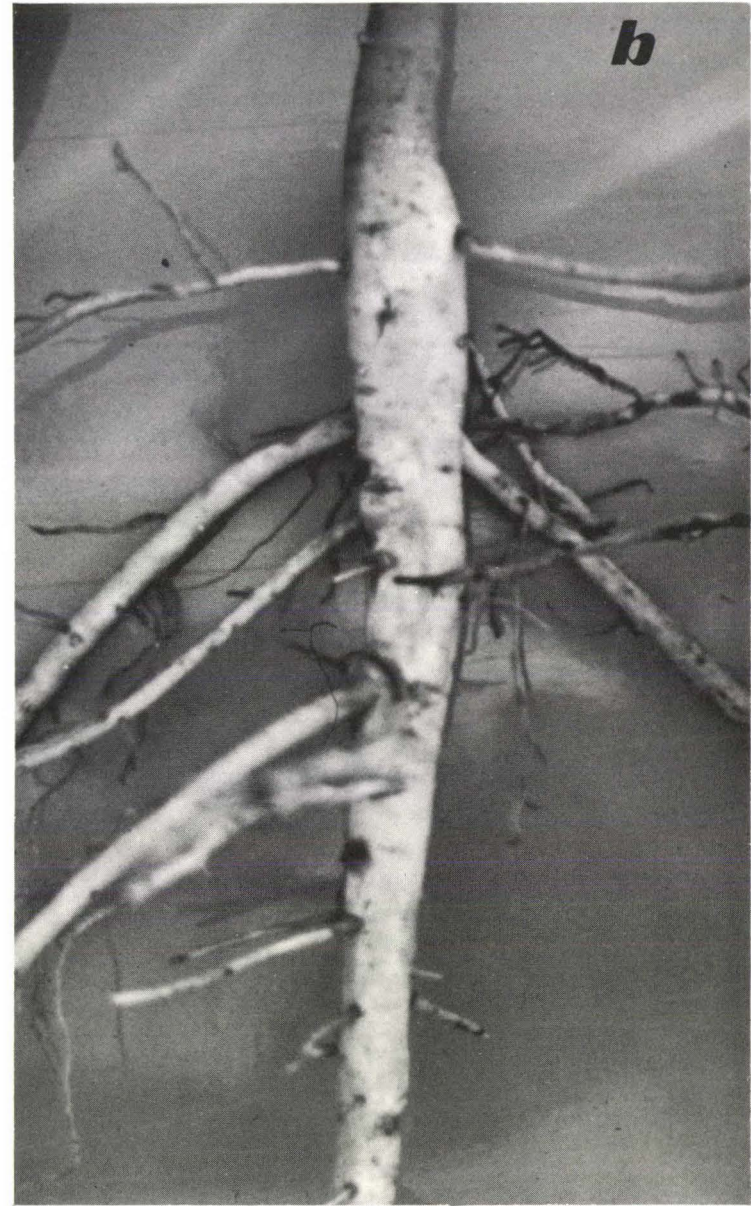
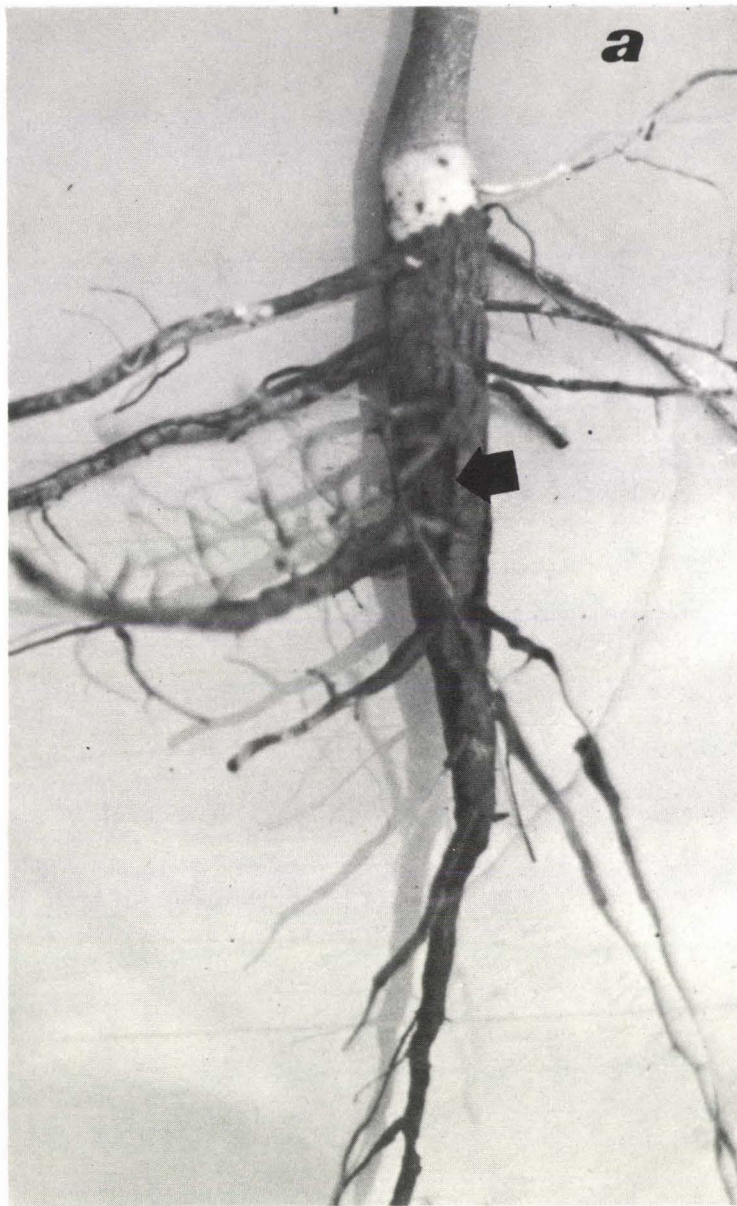


Fig. 2. Symptom expression exemplified by *O. scoparium* infected root (a) as compared with apparently healthy root (b). Note the contrast between the blackened longitudinally-cracked cortex (arrow) on the infected root and the smooth white cortex on the healthy root.

Yellow-poplar seedlings have been grown at the Edwards Nursery since 1961 (Table 1). With one exception, there has been no previous damage observed in any of the yellow-poplar beds. In 1966, some foliage discoloration and poor growth was noted by the nursery personnel in Sections 15, 16 and 17. The "off coloration and stunting" appeared to be minimal, however, and no action was taken. These sections were rotated to corn in 1967. An examination in September, 1968, of 2-0 yellow-poplar seedlings in Sections 1 and 2, Compartment H did not reveal any indication of *C. scoparium* infection. These beds are approximately 200 feet from Section 17, Compartment E (Fig. 1). This suggests a possibility that the fungus, or at least its abnormally high incidence, may be confined to Sections 15-17, Compartment E.

The soil fumigant methyl bromide has been used for many years in the South as a standard practice for sterilizing nursery seed beds. An application of 300 pounds per acre has been considered capable of killing a variety of soil fungi among other organisms (Foster, 1959). However, Hodges (1962) found that the standard recommended dosage rate of methyl bromide (300 pounds per acre) was unsuccessful in destroying the resistant stage (sclerotium) of *C. scoparium*. Hodges recommended a double dosage rate (500-600 pounds per acre) where *Cylindrocladium* root rot presented a problem.

It has also been standard practice at the Edwards Nursery in previous years to fumigate proposed seed beds in the spring with methyl bromide at 300 pounds per acre. In 1968, the fumigation was performed in April. However, this treatment was obviously ineffective in controlling *C. scoparium*. Several factors could have contributed to these results. A relatively high clay soil content in Compartment E (28%) could have reduced the penetrability of the gas along with decreased water drainage. A root pruning operation in the 1-0 yellow-poplar seed beds in 1966 could have increased the spread and incidence of *C. scoparium*. During this operation severed roots as well as a large quantity of soil were translocated throughout the beds. Also, an abundance of possible infection courts was provided for the fungus through the severed roots. Soil preparation work (ploughing and recultivating) since the initial fungus infection, undoubtedly contributed to the subsequent disease spread and incidence. Finally, there is also the possibility of the fungus having been introduced into the area either on contaminated seed or in the sawdust that has been used as a standard mulch for several years.

Table 1 - HISTORY OF THE GROWING STOCK SINCE 1961 IN SECTIONS 15-17,
COMPARTMENT E, EDWARDS STATE FOREST NURSERY, MORGANTON,
NORTH CAROLINA

Year	Section 15	Section 16	Section 17
61-62	Loblolly pine	Yellow-poplar	Yellow-poplar
62-63	Soybeans ^{1/}	Yellow-poplar 2-0 ^{1/}	Yellow-poplar 2-0 ^{1/}
63-64	Sudan grass ^{1/}	Sudan grass ^{1/}	White pine grafting stock
64-65	Sudan grass	Sudan grass	White pine grafting stock
65-66	Yellow-poplar	Yellow-poplar	Yellow-poplar
66-67	Yellow-poplar	Yellow-poplar	Yellow-poplar
67-68	Corn	Corn	Corn
68-69	Yellow-poplar	Yellow-poplar	Yellow-poplar

^{1/} Followed by winter rye cover

RECOMMENDATIONS

The following action is recommended in an effort to alleviate this problem:

1. Refumigate the affected yellow-poplar seedling beds, with either methyl bromide at double strength or a stronger gas. The most recent reports from research, chemical companies and other nurseries experiencing a similar problem indicate that the most effective available soil fumigant for *Cylindrocladium* control is MC-33 (methyl bromide - 67% and chloropicrin - 33%). Trizone has been the most effective soil fumigant in recent years but was taken off the market because of a safety hazard. MC-33 is injected into the soil at a dosage rate of 300-350 pounds per acre (Fig. 3) and the treated beds are covered with plastic sheeting (Fig. 4) similar to the standard methyl bromide soil injection technique. This treatment was recommended to the nursery and was carried out on October 30 and November 1, 1968.
2. The yellow-poplar seedlings were treated in place to minimize the possibility of transporting infected seedlings and/or soil outside the affected area. This represents one of the primary means of spread for *C. scoparium*.
3. All equipment used in the control treatments was steam cleaned as soon as possible after use. Particular emphasis was given to removing all the soil from the ploughs, drag boards, etc. and in no case was contaminated equipment used in another area before being cleaned. The above procedures should be closely followed in similar soil fumigation treatments in the future to minimize the spread of soil-borne nursery pathogens.
4. Sections 15, 16 and 17, Compartment E should be rotated to a cover crop, preferably corn or sudan grass, for a minimum of one year before being replanted to yellow-poplar.
5. A post control evaluation should be made of the area by the Division of Forest Pest Control. Legumes such as alfalfa are highly susceptible to *C. scoparium*. These plants have been suggested as indicators for potential *Cylindrocladium* damage (Bugbee, 1962). Selected portions or strips of the three affected sections should be planted in alfalfa next spring to serve as an indication of the control effectiveness.



Fig. 3. Tractor-drawn soil injection rig. The soil fumigant is released into the soil under pressure at a 6 to 8 inch depth through hoses attached behind each subsoil plough (arrow).



Fig. 4. Soil fumigation procedures in the diseased yellow-poplar seedling beds. The beds were covered with plastic covering immediately after being fumigated.

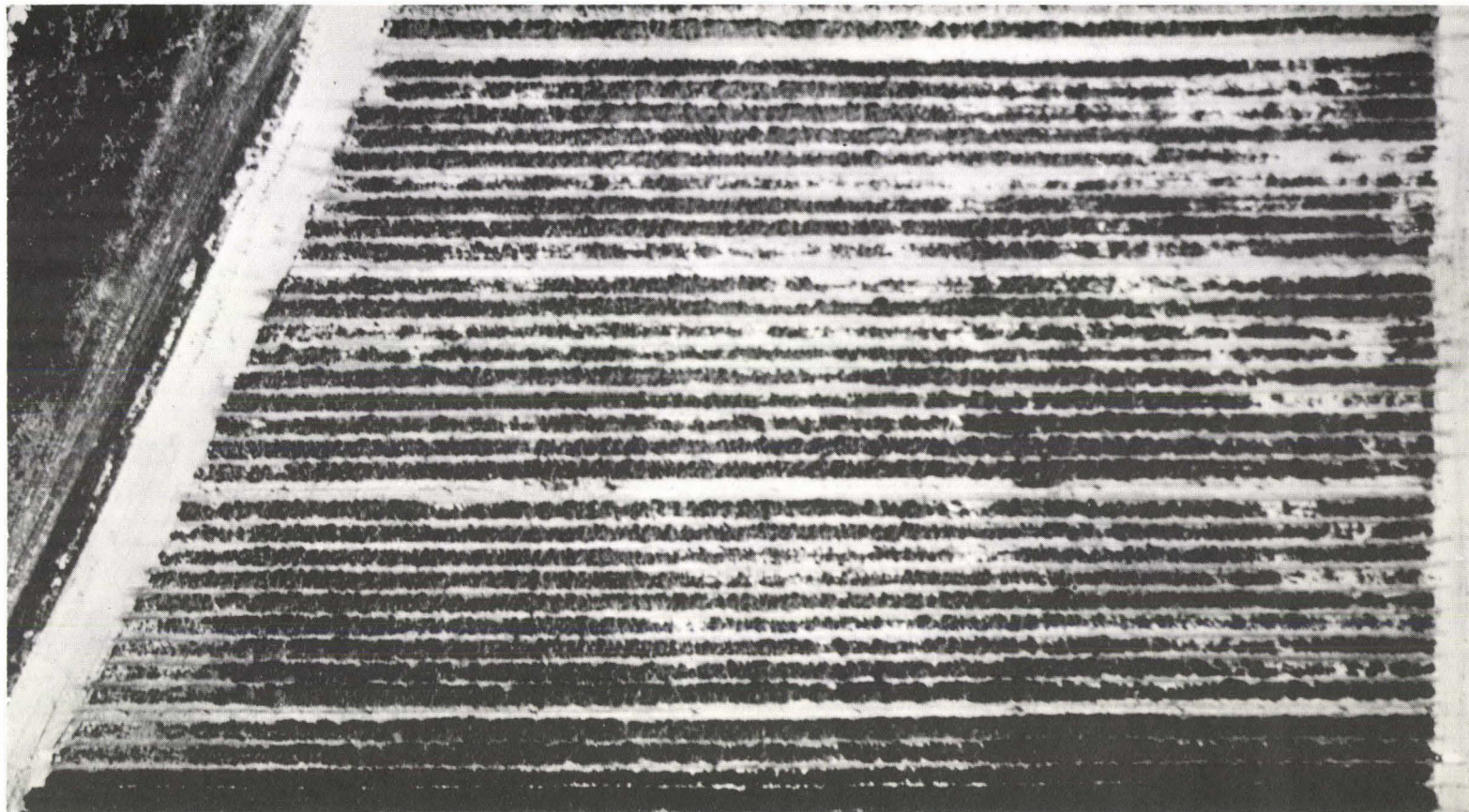


Fig. 5. Aerial photo (scale 1 : 2000) of the yellow-poplar seedling beds damaged by *Cylindrocladium* root rot at the Edwards State Forest Nursery in Morganton, N. C. Note the "patchy", irregular appearance of the 27 affected beds resulting from widespread and severe disease damage.

Any damaged plants will be culturally diagnosed for presence of the fungus. In addition, a supplementary soil bioassay will be made in the area.

6. As an added supplementary precaution, the affected area needs to be fumigated again early next spring (April, 1969) with MC-33 using the same dosage rate and application procedures as used last Fall.
7. One affected bed in Section 17 was left temporarily untreated to permit the testing of several promising fungicides for *C. scoparium* control. The fungicides to be tested are methyl bromide, MC-33 and a new fungicide with the tradename Benlate Benomyl. Each fungicide will be tested at the recommended, one and one-half, and double dosage rates to determine the relative effectiveness and efficiency of each treatment in controlling the disease. These treatments will be implemented next spring (April, 1969) during the second scheduled fumigation of the affected beds first fumigated October 30, and November 1, 1968.

REFERENCES

- Bugbee, W.M. 1962. Host range and bioassay of field soil for *Cylindrocladium scoparium* (Abst.) Phytopathology 52:8 p.726.
- Cox, R.S. 1954. *Cylindrocladium scoparium* on conifer seedlings. Univ. Delaware Agr. Exp. Sta. Tech. Bul. 301. 40pp.
- Foster, A.A. 1959. Nursery diseases of southern pines. USDA, USFS, Forest Pest Leaflet 32. 7pp.
- Hodges, C.S., Jr. 1962. Diseases in southeastern forest nurseries and their control. USDA, USFS, SEFES, Sta. Paper 142. 16pp.
- Jackson, L.W.R. 1938. *Cylindrocladium* associated with diseases of tree seedlings. Plant Disease Repr. 22:1. pp84-85.
- Kelman, A. and G.V. Gooding, Jr. 1965. A root and stem rot of yellow-poplar caused by *Cylindrocladium scoparium*. Plant Disease Repr. 49:9. pp.797-801.
- Ross, E.W. 1967. Association of *Cylindrocladium scoparium* with mortality in a 27-year-old yellow-poplar plantation. Plant Dis. Repr. 51:1. pp.38-39.

More detailed information can be obtained by writing to the Forest Pest Control Division Field Offices listed below or to the Atlanta Office.

FIELD OFFICES

Asheville Office

Amel E. Landgraf, Supervisor
Division of Forest Pest Control
SA, State & Private Forestry, U.S.F.S.
Post Office Box 5895
Asheville, North Carolina 28803

Phone: (704) 254-0961 Ext. 625

FOR STATES OF

Florida
Georgia
Kentucky
North Carolina
South Carolina
Tennessee
Virginia

Alexandria Office

William M. Ciesla, Supervisor
Division of Forest Pest Control
SA, State & Private Forestry, U.S.F.S.
2500 Shreveport Highway
Pineville, Louisiana 71360

Phone: (318) 445-6511 Ext. 311

Alabama
Arkansas
Louisiana
Mississippi
Oklahoma
Texas

AREA OFFICE

Russell K. Smith
Assistant Area Director
Division of Forest Pest Control
50 Seventh Street, N. E.
Atlanta, Georgia 30323

Phone: (404) 526-5189